



NASA STTR 2006 Phase I Solicitation

T4.01 Earth Science Sensors and Instruments

Lead Center: GSFC

Center: GSFC

As part of its mission, NASA seeks to develop a scientific understanding of the Earth system and its responses to natural and human-induced changes to enable improved prediction of climate, weather, and natural hazards for present and future generations. By using breakthrough technologies for terrestrial, airborne, and spaceborne instrumentation, we seek to observe, analyze, and model the Earth system to discover how it is changing and the consequences for life on Earth.

This subtopic is to help provide advanced remote sensing technologies to enable future Earth Science measurements.

Active Remote Sensing Instruments (Lidar)

Lidar remote sensing systems are required to meet the demanding measurement requirements for future Earth Science missions. Instruments are solicited that enable or support the following Earth Science measurements:

- High spatial and temporal resolution observations of the land surface and vegetation cover (biomass);
- Profiling of clouds and aerosols;
- Wind measurements (direct-detection technology only);
- Tropospheric and stratospheric ozone and CO₂ (profiling and total column);
- Measurement of the air/sea interface and mixed layer.

Systems and approaches will be considered that demonstrate a capability that is scalable to space or can be mounted on a relevant platform (UAV or aircraft). New systems and approaches are sought that will:

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- Enable one of the Earth Science measurements listed above;
 - Enhance an existing measurement capability by significantly improving the performance (spatial/temporal resolution, accuracy, range of regard); and/or
 - Substantially reduce the resources (cost, mass, volume, or power) required to attain the same measurement capability.

Passive Remote Sensing Instruments for Unmanned Aerial Vehicles (UAVs)

Spectral imaging devices for remote sensing onboard UAVs are also desired. In particular, uncooled infrared and thermal spectral imager instruments with the following specifications are solicited:

- Instrument must be less than 2 lbs and no larger than 0.05 m³ in volume;
- Must operate autonomously in coordination with the onboard flight plan;
- Must have a built-in data acquisition system;
- Spectral bands must all be coregistered and the data must be GPS time tagged;
- Spectral bands should be centered at 3.75, 3.96, and 11 microns as well as a band in the visible at 0.6 microns; and
- Quantization bit resolution should be 10-bit minimum.

Active Remote Sensing Instruments (Radar) for Aircraft and Unmanned Aerial Vehicles (UAVs)

Active microwave remote sensing instruments are required for future Earth Science missions with initial system concept development and science measurements on aircraft and UAVs. New systems, approaches, and technologies are sought that will enable or significantly advance the capability for:

- Tropospheric wind measurements within precipitation and clouds (X- through W-band);
- Large Ground Penetrating Radars (GPR) (P-band and lower);
- Rain measurements using differential or dual-frequency approaches (X- through Ka-band).

Data Compression

New approaches to data compression, also known as source coding, are needed to assist in transporting science instrument data within constrained communication channels, and/or to reduce the requirements for onboard data storage. Additional benefits of data compression include more science data return and facilitating the direct

broadcast of science data to ground stations. To target multiple missions, implementations should conform to the Consultative Committee for Space Data Systems (CCSDS, www.ccsds.org) recommendation CCDDS 121.0-B 1. This solicitation seeks development of new data compression processors that:

- Can process science instrument data at over 50 Msamples/sec and take science data input from 1-bit/sample and preferably up to 32 bits/sample;
- Can demonstrate radiation tolerance required for both near-Earth and deep space missions; and
- Consume less than 2 watts of electrical power at 50 Msamples/sec.